

First reports of *Milesina* and *Triphragmium* from Turkey

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ABSTRACT—Rust species *Milesina scolopendrii* on *Asplenium scolopendrium* and *Triphragmium filipendulae* on *Filipendula vulgaris* are reported from Melsin, Turkey. These are new generic records from Turkey. The morphological characteristics are described and illustrated based on the collected materials.

KEY WORDS—*Pucciniales*, taxonomy, *Milesinaceae*, *Raveneliaceae*

Introduction

Milesina (*Milesinaceae*) is characterised by white sori and no pigment in all spore stages. Its species are often heteroecious; teliospores are not resting spores, but form during the winter and germinate in the spring; both amphispores and urediniospores are produced by some species (Cummins & Hiratsuka 2003). The genus has 36 species, most of are found in northern temperate regions (Bubner & al. 2019), with eleven species found in Europe, including aecia on fir leaves (Bubner & al. 2019; Kirk & al. 2008).

Triphragmium (*Raveneliaceae*) is distinguished by its three-celled teliospores, with a single pore in each cell and with the pedicel attached to the single basal cell (Cummins & Hiratsuka 2003). *Triphragmium* contains seven species. In the northern hemisphere, three *Triphragmium* species parasitize *Filipendula* hosts (Farr & Rossman 2022).

According to the literature on Turkish rust fungi (Akdeniz & Sert 2021; Bahçecioğlu 2014; Bahçecioğlu & Kabaktepe 2012; Kabaktepe 2015; Kabaktepe

& Bahçecioğlu 2012; Kabaktepe & al. 2015a,b,c, 2016, 2017a,b; Kirbag & al. 2011, Özaslan & al. 2015), 375 species belonging to 28 genera have thus far been recorded from Turkey.

Here we report the first records of *Milesina* and *Triphragmidium* from Turkey.

Materials & methods

Specimens of host species were collected from Bolkar mountains (Mersin) in Turkey during 2013–15. The Flora of Turkey (Peşmen & Chamberlain, 1972) was the main literature used for the identification of the host species. Names of host plants and families are given according to WFO: The World Flora Online (<http://www.worldfloraonline.org/>). Rust fungi were identified morphologically by using methods of Gäumann (1959), Wilson & Henderson (1966), and Ellis & Ellis (1987). Names of fungi were checked from Index Fungorum (<http://www.indexfungorum.org>). All studied specimens were deposited in the Herbarium of İnönü University, Malatya, Turkey (INU).

For light microscopy, the fungal specimens were isolated from the plant materials either by scraping, or thin sections with a razor blade and spores were scraped from dried host specimens, mounted in lactophenol, and examined with a light microscope. Digital images were made using a Leica light microscope and an Olympus SZ65 stereomicroscope camera. Image Focus v3 analyzing software was used to measure spores. For scanning electron microscopy (SEM), spores were fixed on stubs by using double-sided adhesive tape, coated with gold, and examined using an EVO 40XVP (LEO Ltd., Cambridge, UK) scanning electron microscope at an accelerating voltage of 20 kV.

Taxonomy

Milesina scolopendrii (Fuckel) Jaap, Fung. Sel. Exs.: no. 571 (1912) FIG. 1

Spermogonia and aecia not seen. Uredinia hypophyllous, scattered or in groups, between veins, greenish-brownish, covered by the epidermis. Urediniospores $24\text{--}55 \times 14\text{--}27 \mu\text{m}$, obovoid, clavate or ellipsoid, wall colorless, $0.5\text{--}1.5 \mu\text{m}$ thick, remotely spinulose, spines up to $3 \mu\text{m}$, pores scattered, up to 9, mostly 5–6. Telia and basidia not seen.

SPECIMENS EXAMINED—On *Asplenium scolopendrium* L. (*Aspleniaceae*): **TURKEY:** **MERSIN:** **Toroslar**, 3 km from Aslanköy to Fındıkpınarı, 20.Sept.2014, Ş. Kabaktepe & I. Akata 7877 (INU 1284); **Çamlıyayla**, Kadıncık valley, Papaz garden located, 820–850 m a.s.l., 26.Jun.2015, Ş. Kabaktepe & I. Akata 8154 (INU 1296).

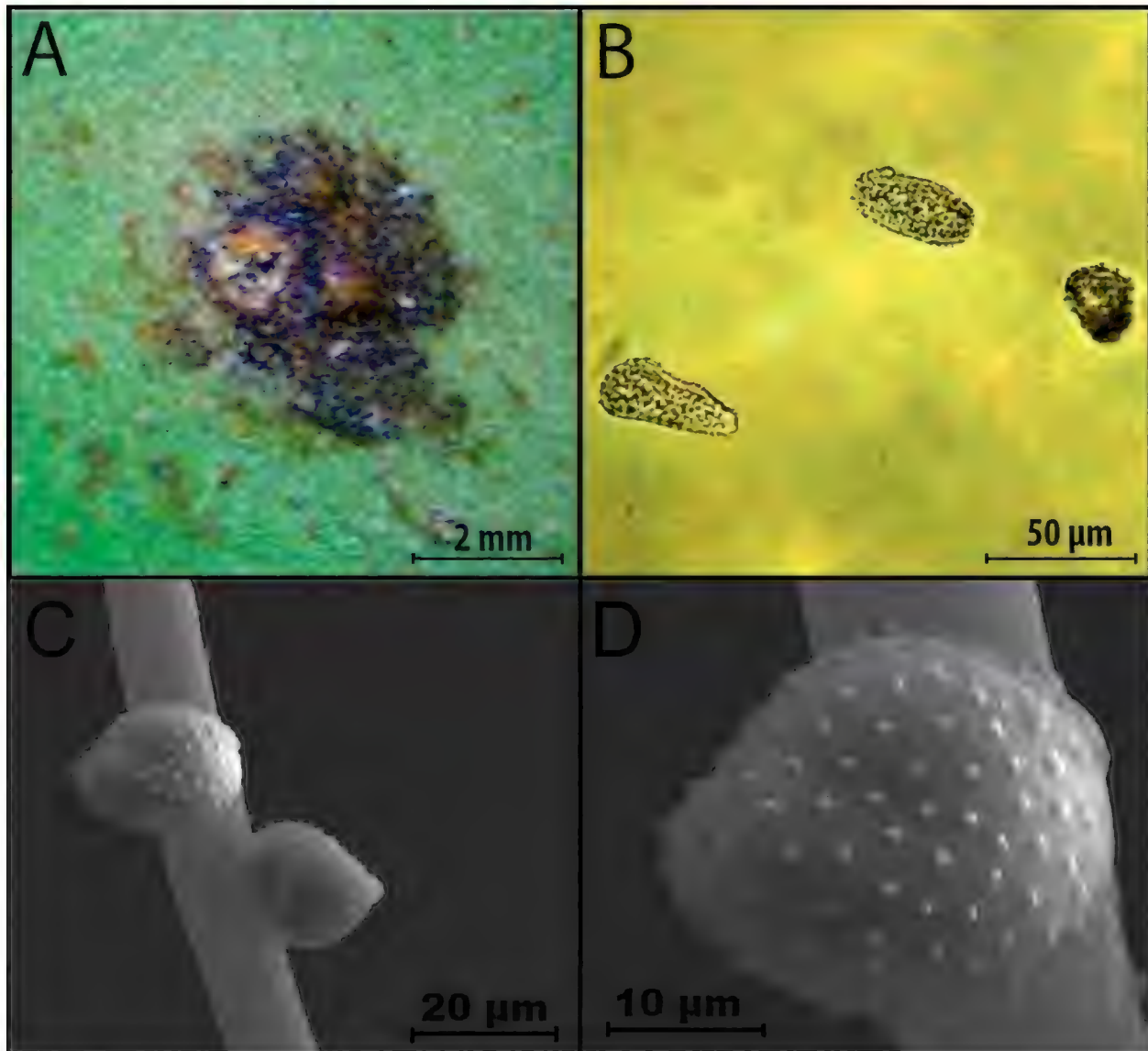


FIG. 1. *Milesina scolopendrii* (INU 1296) on *Asplenium scolopendrium*. A: infected area on leaf tissue; B: urediniospores; C: urediniospores (SEM); D: urediniospore surface (SEM).

REMARKS: Although five rust fungi species have been reported on *Asplenium* in Turkey, this is the first Turkish report of a *Milesina* species on that host genus (Bahçecioğlu & Kabaktepe, 2012; Sesli & al, 2020).

Milesina species growing on *Asplenium* are morphologically similar, but can be distinguished from each other by the size, shape, and ornamentation of their urediniospores and by their host species.

Five *Milesina* species have *Asplenium* hosts: *M. asplenii-incisi* (Faull) Hirats. on *A. incisum* Thunb.; *M. feurichii* (Magnus) Grove on *A. septentrionale* (L.) Hoffm.; *M. magnusiana* Jaap on *A. adiantum-nigrum* L.; *M. murariae* (Magnus) Grove on *A. ruta-muraria* L.; and *M. scolopendrii* on *A. scolopendrium*.

M. scolopendrii is characterized by remotely spinulose and large urediniospores (up to 55 µm). It is separated from *M. asplenii-incisi* (up to 26

µm), *M. magnusiana* (up to 35 µm), and *M. murariae* (up to 35 µm) by its larger urediniospores size; and from *M. feurichii* (densely echinulate) by the sparse ornamentation of its urediniospores.

Triphragmium filipendulae (Lasch) Pass., Nuovo Giorn. Bot. Ital.7(3): 255 (1875).

FIG. 2

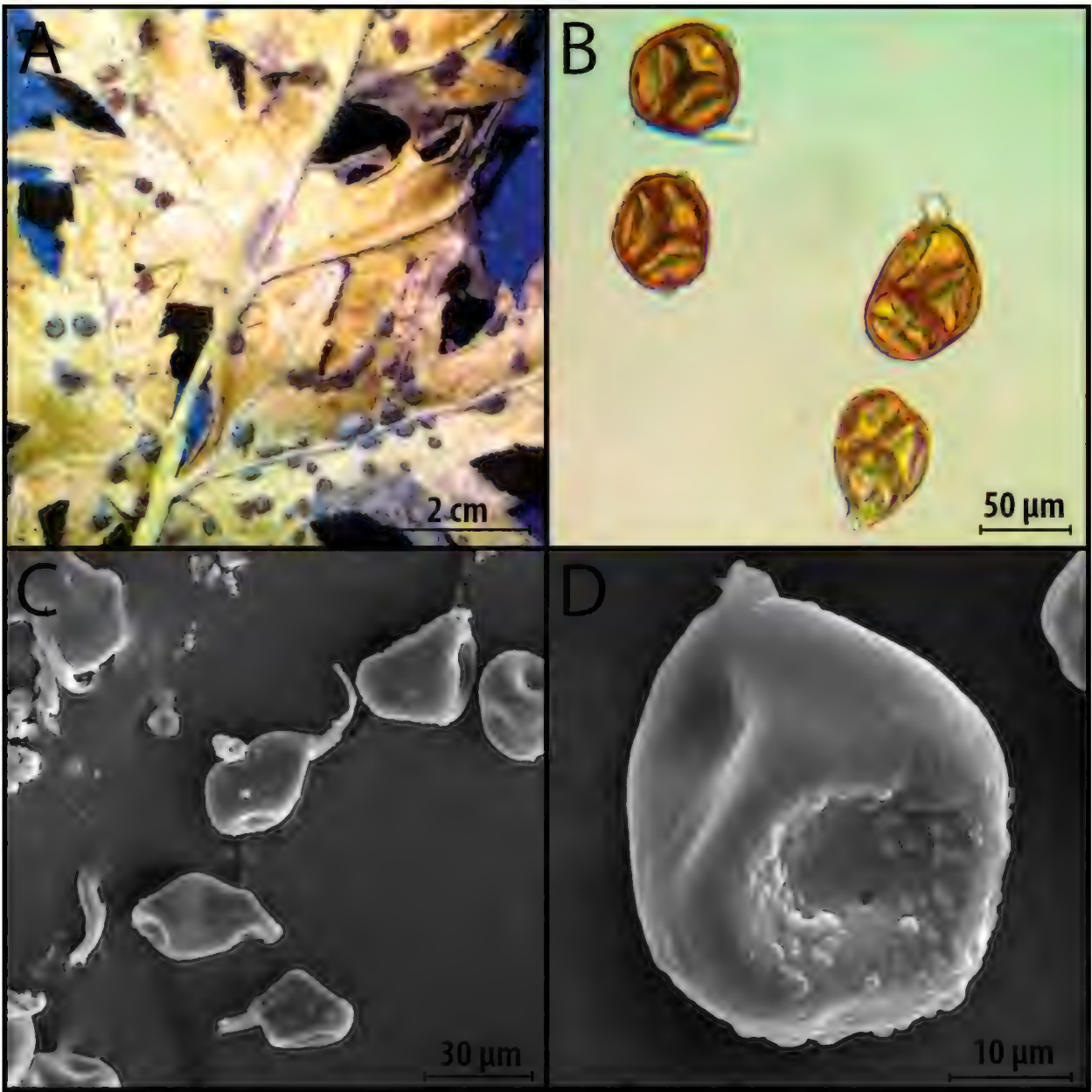


FIG. 2. *Triphragmium filipendulae* (INU 1272) on *Filipendula vulgaris*. A: infected area on leaf tissue; B: teliospores; C, D: teliospores (SEM).

Spermogonia and aecia not seen. Uredinia hypophyllous, scattered, pale orange. Urediniospores 19–30 × 15–21 µm, subglobose, ellipsoid, ovoid, or pyriform, wall pale yellow, up to 2 µm thick, echinulate, pores indistinct. Telia

hypophyllous, scattered, dark brown. Teliospores $28\text{--}60 \times 18\text{--}44 \mu\text{m}$, elliptic, scarcely or not constricted at septa, 3-celled (1 basal, 2 apical), each cell with a single pore, brown, smooth or with few warts around the pores, in SEM views small warts especially on pores, pedicel hyaline, equal the spore in length, deciduous. Basidia not seen.

SPECIMENS EXAMINED—On *Filipendula vulgaris* Moench (*Rosaceae*). **TURKEY:** **MERSIN: Çamlıyayla**, Saydibi plateau, 1800–1880 m a.s.l., 09.July.2013, Ş. Kabaktepe & I. Akata 7345 (INU 1272) ; **Tarsus**, Gülek, Karboğazi, 1700–1800 m a.s.l., 17.Jul.2014, Ş. Kabaktepe & I. Akata 7657 (INU 1285); **Mezitli**, 3 km from Tepeköy to Kocayer, 1140 m a.s.l., 20.Sept.2014, Ş. Kabaktepe & I. Akata 7881 (INU 1286).

REMARKS: Even though three species of *Triphragmium* (*T. filipendulae*, *T. ulmariae* (DC.) Link, and *T. vassilievae* Azbukina) have been reported on *Filipendula* hosts, the genus has not previously been recorded on *Filipendula* in Turkey (Bahçecioğlu & Kabaktepe 2012; Sesli & all., 2020).

Triphragmium ulmariae and *T. vassilievae* are very close to *T. filipendulae* in terms of their similar host and morphology. The smooth cell walls of the teliospores are the characteristic feature of *T. Filipendulae*, while the others have some development of warts on their teliospores.

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